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ईथाईल ईथर – सुरक्षा संहिता

Indian Standard

ETHYL ETHER — CODE OF SAFETY

UDC 547·272 : 614·8

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TO
IS 13441 : 1992 ETHYL ETHER — CODE OF SAFETY

(*Page* 1, *clause* **4.4.2**) — Substitute '*Auto-Ignition Temperature – 160°C*' *for* '*Auto-Ignition Temperature — 215°C*'.

(*Page* 2, *clause* **5.1**) — Delete the line 'Ethyl ether is a suspected carcinogen' and substitute 'TLV (TWA)' *for* 'TLV'.

(*Page* 2, *clause* **5.2**, *line* 1) — Substitute '**LD_{50} Oral Rat** — 1 215 mg/kg' *for* '**LD 50 Oral Rat** — 1 700 mg/kg'.

(CHD 8)

Reprography Unit, BIS, New Delhi, India

Chemical Hazards Sectional Committee, CHD 007

FOREWORD

This Indian Standard was adopted by the Bureau of Indian Standards, after the draft finalized by the Chemical Hazards Sectional Committee had been approved by the Chemical Division Council.

Ethyl Ether has a wide range of uses. It is a good solvent for many organic substances among which are oils, fats, gums, resins, certain select nitrocelluloses, perfumes and alkaloids. A mixture of ethyl ether and ethyl alcohol has excellent solvent properties for nitrocelluloses and is used in large quantities for this purpose. Another important use of ethyl ether is as an extracting medium for the concentration of acetic and other organic acids. It is used as a reaction medium in Wurtz and Grignard syntheses, as a starting fuel for diesel engines, and as an entrainer for dehydration of ethyl alcohol and isopropyl alcohol. Ethyl ether is used as a general anesthetic in surgery.

It is a colourless, volatile and highly flammable liquid with a sweet pungent odour. Ethyl ether is miscible with ethyl alcohol, oils and the usual organic solvents in all proportions.

In the preparation of this code of safety, considerable assistance has been derived from the following publications:

a) Encyclopedia of Chemical Technology by Raymond E. Kirk and Donald F. Othmer — Japanese Reprint edition published by Maruzen Company, Tokyo, Japan.

b) Dangerous Properties of Industrial Materials — N. Irivin Sax — Sixth edition.

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Indian Standard

ETHYL ETHER — CODE OF SAFETY

1 SCOPE

1.1 This standard covers properties of ethyl ether, nature of hazards associated with it and essential information of personal protective equipment, storage, handling, labelling, transport, spillage/leakage and waste disposal, fire prevention and fire fighting, training and health monitoring and first aid.

1.2 This standard does not deal with specifications for design of buildings, chemical engineering plants, storage vessels, equipment for operation controls and waste disposal.

2 REFERENCES

The following Indian Standards are the necessary adjuncts to this standard:

IS No.	*Title*
1260 (Part 1) : 1973	Pictorial marking for handling and labelling of goods : Part 1 Dangerous goods (*first revision*)
4155 : 1966	Glossary of terms relating to chemical and radiation hazards and hazardous chemicals
10592 : 1982	Specification for industrial emergency showers, eye and face fountains and combination units

3 TERMINOLOGY

For the purpose of this standard, definitions given in IS 4155 : 1966 shall apply.

4 PROPERTIES

4.1 General Information

Ethyl ether is a colourless, volatile and highly inflammable liquid with a sweet pungent odour.

4.1.1 *Common Names* — Ethyl ether, Ethoxethane (I.U.P.A.C.), ether, anesthesia ether, sulphuric ether, solvent ether.

4.1.2 *Chemical Names* — Diethyl ether, ethyl oxide.

4.1.3 *Empirical Formula* — $C_2H_5OC_2H_5$.

4.1.4 *Molecular Formula* — $C_4H_{10}O$.

4.1.5 *Molecular Weight* — 74·1.

4.2 Physical Properties

4.2.1 *Description, Colour, Odour, Physical State*

Ethyl ether is a colourless, volatile, highly inflammable liquid with a sweet pungent odour. Odour threshold limit is 0·83 ppm.

4.2.2 *Freezing Point* — minus 116·2°C.

4.2.3 *Boiling Point* — 34·6°C.

4.2.4 *Specific Gravity* — 0·713 5 at 20°C/4°C.

4.2.5 *Viscosity* — 0.244 8 centipoise at 20°C.

4.2.6 *Vapour Pressure* — 58·15 kPa at 20°C.

4.2.7 *Miscibility/Solubility*

The solubility of ethyl ether in water at 20°C is 6·8 percent by mass and that of water in ethyl ether at 20°C is 1·2 percent by mass. It is miscible with ethyl alcohol, oils and the usual oils and the usual organic solvents in all proportions.

4.2.8 *Vapour Density* — 2·56 (air = 1)

4.3 Chemical Properties

4.3.1 Although ether is relatively unreactive, like ethers in general a few of its reactions are worth noting. The spontaneous formation of non-volatile peroxides on standing in air, especially in the light is important from the stand point of the resultant hazards. The peroxide remains as a residue when ether evaporates and may explode violently in a distillation carried out to dryness. Weak acids or water bring about peroxide decomposition to hydrogen peroxide and ethyl alcohol.

4.3.2 *Stability at High Temperature* — Auto-igniter at 180 to 190°C.

4.3.3 *Flammability* — Highly flammable.

4.4 Fire and Explosion Hazards

4.4.1 *Flash Point (Close Cup)* — minus 45°C.

4.4.2 *Auto-Ignition Temperature* — 215°C.

4.4.3 *Explosion Hazard* — 1·85 to 36·5 percent by volume in air.

4.5 Corrosion Properties

Ethyl ether is a suspected carcinogen.

5 HEALTH EFFECTS AND TOXICITY INFORMATION

5.1 Ethyl ether is a suspected carcinogen.

TLV — 400 ppm
STEL - 500 ppm

5.2 LD 50 Oral Rat — 1 700 mg/kg.

Toxicity by ingestion — Grade 2, LD_{50} — 0·5 to 5 g/kg*, LD_{LO} 260 mg/kg.

5.3 It is absorbed almost instantly from the lungs and very promptly from the intestinal tract. It undergoes no chemical change in the body. The maximum safe atmospheric concentrations of ethyl ether for prolonged exposure have not been determined under industrial conditions.

5.4 It is not safe for individual to inhale or ingest vapours of ether. It is not toxic in the sense of being a poison. It is however, a depressant of the central nervous system (CNS) and is capable of producing intoxication, drowsiness, stupor, and unconsciousness. Death due to respiratory failure may result from over exposure.

6 PERSONAL PROTECTIVE EQUIPMENT

6.1 Respiratory

a) Gas mask with approved organic vapour canister (for minor leakages and spills), and
b) Self contained breathing or air line respirator.

6.2 Non-respiratory

a) Hand gloves and apron made of PVC, neoprene or butyl rubber.
b) Safety goggles made of toughened glass.
c) Full cover face shield.
d) Over-shoe made of neoprene or rubber or PVC over the normal shoes.

7 STORAGE, HANDLING AND TRANSPORT

7.1 Storage

Due to its flammability ethyl ether should not be stored close to other materials that pose fire or explosion hazard. Bung walls should be provided around bulk storage tanks above ground level.

7.1.1 Special containers have to be used for anesthetic ether to prevent deterioration before use. Their effectiveness as stabilizers usually depends upon the presence of a lower oxide of a metal having more than one oxidation state.

7.1.2 All rooms where ethyl ether is stored should be fire resistant and be provided with adequate ventilation.

7.1.3 All electrical wirings, light fittings, motors etc, installed or used where ethyl ether is handled or stored should be essentially flame proof type only. All storage tanks should be fitted with a vent pipe/breather. All plant and machinery handling ethyl ether shall be effectively earthed for controlling undesirable static electricity. Structural steel work shall be effectively earthed with plant/equipment bonded to the structural steel work.

7.1.4 Bulk storage areas should be away from the sources of open flame, heaters, furnaces and welding or other flame or spark-producing equipments. 'NO SMOKING' signs should be conspicuously displayed in the area. All storage tanks should be grounded and provided with continuous water sprinkler arrangements for cooling. Joints in the pipelines used for transporting ethyl ether should be bonded.

7.2 Handling

7.2.1 The area where ethyl ether is handled should be declared as a class I hazard location.

7.2.2 All equipment used for maintenance purposes should be made of non-sparking metal alloys. Utmost care should be exercised while loading and unloading ether by employing carefully instructed and reliable personnel.

7.3 Labelling

7.3.1 Hazard warning symbols/labels should be displayed in the plant areas. Cautionary/warning notices such as "SMOKING AND NAKED FLAME VERY STRICTLY PROHIBITED. SPILLAGE BE AVOIDED" may be displayed.

7.3.2 Labels of containers should indicate the following details :

a) Name of material;
b) Vapour hazardous and very highly flammable; and
c) Keep away from heat, sparks and open flame.

CAUTION

a) Do not breathe vapour;
b) Avoid contacts with eyes, skin and clothings;

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*Hazardous Chemicals Handbook—G. Weiss.

c) Ensure adequate ventilation; and
d) Keep container closed.

7.4 Transport

7.4.1 Personnel protective wears consisting of neoprene or PVC gloves, boots and suit, together with compressed air breathing apparatus with full face mask should be used when handling and transporting ethyl ether.

7.4.2 Loading and unloading operations shall not be undertaken by an operator on his own.

7.4.3 Adequate ventilation must be provided during transfer of ethyl ether from one container to another.

7.4.4 A safety shower should be in the near vicinity of any loading or unloading area.

7.4.5 Ethyl ether may be transported in drums and tankers of approved design and construction as per instructions laid down. The drums should be thoroughly steamed or washed with water. The tankers shall be constructed of steel.

7.4.6 The labelling and transport of ethyl ether should be in accordance with IS 1260 (Part 1) : 1975.

8 SPILLAGE/LEAKAGE AND WASTE DISPOSAL

8.1 Waste mixtures containing diethyl ether should not be allowed to enter drains or sewers where serious explosions may result. The following methods are recommended for disposal. For obvious reasons of fire hazard, spillage of ethyl ether should be carefully avoided.

8.2 There should be adequate arrangement for collection of spills or leaks of ethyl ether and for destruction by burning. There should be arrangement for water washing of floors/areas. Letting out ethyl ether waste into municipal drains, sewers directly or to the earth or underground water should be avoided.

8.3 Contaminated earth, sand or absorbent materials shall be collected and chemically treated over a period until they are rendered safe for disposal. Alternatively, the contaminated materials may be incinerated.

9 FIRE PREVENTION AND FIRE FIGHTING

9.0 General

Ethyl ether is very dangerous when exposed to heat or flame and reacts vigorously with peroxide air, liquid air, bromazide Cl_2, ClF_3, CrO_3, C_rCDCL_2, $ZiAlH_2$, $NaClO_4$, O_2, $NClO_2$, O_3, $HClO_4$, (H_2SO_4 + Permanganates), K_2O_2, Na_2O, (C_2H_5)$_3$ Al+ air, {$C(CH_3)_3)_3$ Al + air}.

9.1 Best house keeping and strict adherence to all standing orders will avert any mishap involving diethyl ether.

9.2 Types of extinguishing agents and equipments which can be used are dry chemical powder extinguishers, alcohol foam extinguishers and applicator carbon dioxid type.

10 TRAINING AND HEALTH MONITORING

10.1 Training/Education

10.1.1 Employees handling ethyl ether shall be provided with adequate information on the properties and hazards of ethyl ether before they handle through well planned training programme.

10.1.2 Preplacement training in emergency procedures shall include fire fighting, disposal of spills and first aid.

10.1.3 Persons handling ethyl ether should be instructed to use protective wears.

10.1.4 All workers should be familiar with the location of safety showers, alarm boxes, emergency ventilation systems, first aid boxes, fire extinguishers and hose lines, protective equipments, gas masks and artificial respiration kits. They should be given training in the methods of operation of these equipments mentioned.

10.1.5 Periodical refresher training shall be imparted to the staff members who handle ethyl ether.

10.2 Health Monitoring

10.2.1 Pre-employment examination is required for persons who would be exposed to ethyl ether. Persons subject to fainting, various types of cardivascular and nervous disorders should not be employed. Periodic health examination including X-ray, test on the intestinal tract including faecal occult blood, screening of skin, respiratory tract, heart, central nervous system and liver should be performed on all employees exposed to ethyl ether.

10.2.2 A periodical surveillance of the peripheral and the central nervous systems, respiratory and gastro intestinal systems may be done on all persons exposed to ethyl ether continuously. Proper records should be maintained so that any abnormal variation may be studied and remedies suggested by the physician.

10.2.3 Periodical examination has to be done annually.

11 FIRST AID

11.1 In case of skin contacts the contaminated clothing are removed. The skin is washed thoroughly with water.

11.2 In case of contact with eyes, the eyes are flushed thoroughly with water for at least 15 minutes. No lotion or ointment may be applied. The physician is to be contacted if irritation/inflammation persists.

11.3 In case of exposure to high concentrations resulting in narcotic symptoms the patient is shifted to an uncontaminated area at once. If breathing is difficult artificial respiration should be administered and a physician called in.

11.4 Emergency Actions

11.4.1 It cannot be assumed that an incident involving a very major leak of ethyl ether will not occur which involves people both within and outside the works. Accordingly, the emergency actions as given in **11.4.2** to **11.4.5** are to be kept in view.

11.4.2 *Local Emergency Action*

The fire brigade, ambulance, hospitals and police should be kept notified of the potential hazards of ethyl ether and be given all necessary information so that they can deal with any emergent situations that may arise.

11.4.3 Practicable emergency procedures should be drawn up defining the action plan when a major incident occurs. The procedure should be a workable one and accepted by the local emergency services. Periodic practice drills may be arranged with all concerned to test the effectiveness of the contingency plans.

11.4.4 It would be the responsibility of the local emergency services to warn the local people in case of any incident in which a warning becomes necessary.

11.4.5 Emergency procedures should provide for :

a) Prompt recognizing of incidents presenting risk to plant, personnel and/or the public at large;

b) Immediate alerting of the appropriate emergency service;

c) Monitoring down-wind of any large escape;

d) Acting to control the incident and mitigate the effects;

e) Protecting personnel within and outside the works;

f) Making safe the other plants in the affected area; and

g) Bringing in the requisite additional safety resources.

11.5 Adequate number of safety showers conforming to IS 10592 : 1982 should be provided at appropriate locations.

11.6 Information should be provided to the physician rendering medical aid, as under.

11.6.1 Send the patient with case history or full details of accident including the name of the chemical which caused the injury or sickness.

11.6.2 Include the suggested treatment if proper antidote, etc. could be specified confidently. Otherwise leave it to the physician.

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